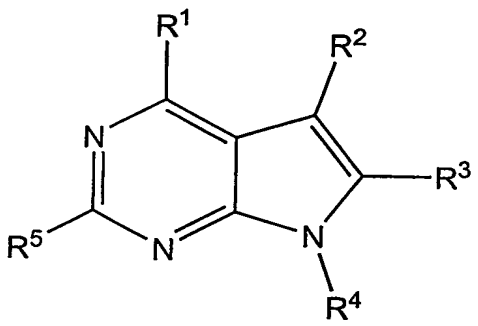
WHAT IS CLAIMED IS:

1. A pyrrolopyrimidine compound having an electrophilic substituent that is capable of forming a covalent bond with a cysteine residue within the ATP binding site of a kinase, exclusive of the compound 5-(4-phenoxyphenyl)-6-cyano-7-cyclopentyl-4-aminopyrrolo[2,3-d]pyrimidine.

2. A compound having the formula (I):



(I)

in which:

R^1 is NHR^a wherein R^a is hydrogen or an optionally substituted aliphatic, aromatic or heterocyclic group or R^a is an electrophilic group E;

R^2 is hydrogen or a group having the formula $(CH_2)_bR^b$ wherein *b* is 0 or an integer from 1 to 3 and R^b is an aromatic, heterocyclic or cyclical aliphatic group optionally substituted with one or more groups selected from lower alkyl, halogen, substituted alkyl, nitro, alkoxy, phenoxy, sulfonamido, carboxylic ester, or carboxamide, or R^2 is an electrophilic group E;

R^3 is hydrogen or an aliphatic, aromatic, or heterocyclic group or an electrophilic group E;

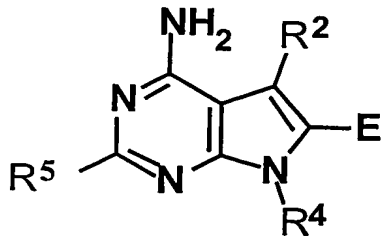
R^4 is an aliphatic, aromatic, or heterocyclic group optionally substituted with one or more polar groups, which polar group may be protected or unprotected, or R^4 is an electrophilic group E;

R^5 is hydrogen or an alkyl- or aryl-substituted ether, thioether, or amine, or an electrophilic group E; and

E is an electrophilic group capable of forming a covalent bond with a cysteine residue within the ATP binding site of a kinase;

provided that one of R^1 - R^5 is an electrophilic group E and further provided that the compound is not a compound in which R^1 is NH_2, R^2 is 4-phenoxyphenyl, R^3 is cyano, R^4 is cyclopentyl, and R^5 is hydrogen.

3. A compound having the formula (IA):



(IA)

in which

R^2 is hydrogen or a group having the formula $(CH_2)_bR^b$ wherein *b* is 0 or an integer from 1 to 3 and R^b is an aromatic, heterocyclic or cyclical aliphatic group optionally substituted with one or more groups selected from lower alkyl, halogen, substituted alkyl, nitro, alkoxy, phenoxy, sulfonamido, carboxylic ester, or carboxamide;

R^4 is an aliphatic, aromatic, or heterocyclic group optionally substituted with one or more polar groups, which polar group may be protected or unprotected;

R^5 is hydrogen or an alkyl- or aryl-substituted ether, thioether, or amine; and

E is an electrophilic group capable of forming a covalent bond with a cysteine residue within the ATP binding site of a kinase;
provided that the compound is not a compound in which, R^2 is 4-phenoxyphenyl, E is cyano, R^4 is cyclopentyl, and R^5 is hydrogen.

4. A compound according to claim 2 or 3 in which E is an electrophilic group that comprises a carbonyl, an epoxide, or an olefin conjugated to an electron withdrawing group.

5. A compound according to claim 2 or 3 in which R^2 is hydrogen.

6. A compound according to claim 2 or 3 in which R^2 is a group having the formula $(CH_2)_bR^b$.

7. A compound according to claim 6 in which *b* is 0.

8. A compound according to claim 7 in which R^2 is an optionally substituted phenyl group.

9. A compound according to claims 2 or 3 in which E comprises a carbonyl, an epoxide, or an olefin conjugated to an electron withdrawing group.

10. A compound according to claim 9 in which E comprises an olefin conjugated to a carbonyl, nitro, cyano, carboxyl, carboxamide, sulfoxide, sulfonyl, sulfonamide, or sulfonate group.

11. A compound according to claims 2 or 3 in which E comprises a carbonyl group.

12. A compound according to claim 11 in which the carbonyl group has the formula $-C(O)(CH_2)_nR$ in which R is a halogen and *n* is 0 or an integer from 1 to 6.

13. A compound according to claim 12 in which *n* is 0.

14. A compound according to claim 12 in which *n* is 1.

15. A compound according to claim 11 in which the carbonyl group has the formula $-(CH_2)_mC(O)R$ in which *m* is 0 or an integer from 1 to 6 and R is a halogen.

16. A compound according to claim 15 in which *m* is 0.

17. A compound according to claim 15 in which *m* is 1.

18. A compound according to any of claims 12-17 in which R is chloro.

19. A compound according to any of claims 12-17 in which R is fluoro.

20. A compound according to claim 11 in which the carbonyl group comprises an olefinically unsaturated ketone.

21. A compound according to claim 20 in which the carbonyl group is -C(O)CH=CH_2.

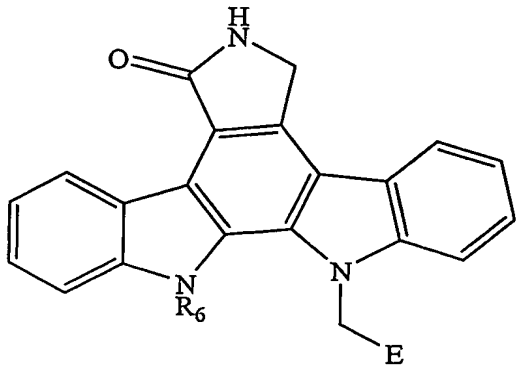
22. A compound according to claims 2 or 3 in which E is an olefin carboxylate having the formula CH=CHC(O)OR' where R' is an optionally substituted aliphatic, aromatic, or heterocyclic moiety.

23. A compound according to claim 22 in which R' is methyl.

24. A compound according to claims 2 or 3 in which E is an olefin carboxamide having the formula -CH=C(O)NR"R"' where R" and R"' are optionally substituted aliphatic, aromatic, or heterocyclic moieties.

25. A compound according to claims 2 or 3 in which E comprises an epoxide.

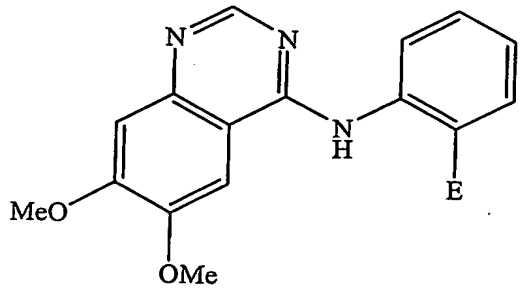
26. A compound having the formula (II):



(II)

in which R_6 is hydrogen or an optionally substituted aliphatic, aromatic or heterocyclic group and E represents an electrophilic group that is capable of reacting with a cysteine residue within the ATP binding site of a kinase.

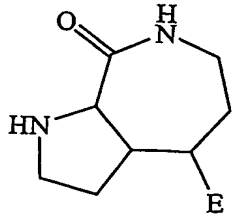
27. A compound having the formula (III):



(III)

in which E represents an electrophilic group that is capable of reacting with a cysteine residue within the ATP binding site of a kinase.

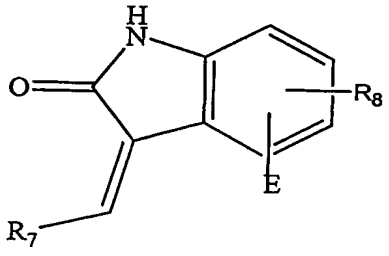
28. A compound having the formula (IV):



(IV)

in which E represents an electrophilic group that is capable of reacting with a cysteine residue within the ATP binding site of a kinase.

29. A compound having the formula (V):



(V)

in which R_7 is a group having the formula $(CH_2)_bR^b$ wherein *b* is 0 or an integer from 1 to 3 and R^b is an aromatic, heterocyclic or cyclical aliphatic group; R_8 is hydrogen or one or more substituents that do not affect the kinase-inhibiting properties of the said compounds, and E represents an electrophilic group that is capable of reacting with a cysteine residue within the ATP binding site of a kinase.

30. A compound according to any of claims 26-29 in which E comprises a carbonyl, an epoxide, or an olefin conjugated to an electron withdrawing group.

31. A compound according to any of claims 26-29 in which E comprises an olefin conjugated to a carbonyl, nitro, cyano, carboxyl, carboxamide, sulfoxide, sulfonyl, sulfonamide, or sulfonate group.

32. A compound according to any of claims 26-29 in which E comprises a carbonyl group.

33. A compound according to claim 32 in which the carbonyl group has the formula $-C(O)(CH_2)_nR$ in which R is a halogen and *n* is 0 or an integer from 1 to 6.

34. A compound according to claim 33 in which *n* is 0.

35. A compound according to claim 33 in which *n* is 1.

36. A compound according to claim 32 in which the carbonyl group has the formula $-(CH_2)_mC(O)R$ in which *m* is 0 or an integer from 1 to 6 and R is a halogen.

37. A compound according to claim 36 in which *m* is 0.

38. A compound according to claim 36 in which *m* is 1.

39. A compound according to any of claims 33-38 in which R is chloro.

40. A compound according to any of claims 33-38 in which R is fluoro.

41. A compound according to claim 32 in which the carbonyl group comprises an olefinically unsaturated ketone.

42. A compound according to claim 41 in which the carbonyl group is $-C(O)CH=CH_2$.

43. A compound according to any of claims 26-29 in which E is an olefin carboxylate having the formula CH=CHC(O)OR' where R' is an optionally substituted aliphatic, aromatic, or heterocyclic moiety.

44. A compound according to claim 43 in which R' is methyl.

45. A compound according to any of claims 26-29 in which E is an olefin carboxamide having the formula -CH=C(O)NR"R"' where R" and R"' are optionally substituted aliphatic, aromatic, or heterocyclic moieties.

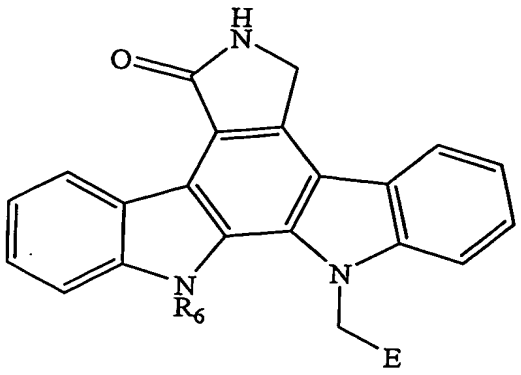
46. A compound according to any of claims 26-29 in which E comprises an epoxide.

47. A method of inhibiting a protein kinase that has one or more cysteine residues within its ATP binding site, comprising contacting the kinase with an inhibitory-effective amount of a compound having a heterocyclic core structure comprised of two or more fused rings containing at least one nitrogen ring atom, and an electrophilic substituent that is capable of forming a covalent bond with a cysteine residue within the ATP binding site of a kinase.

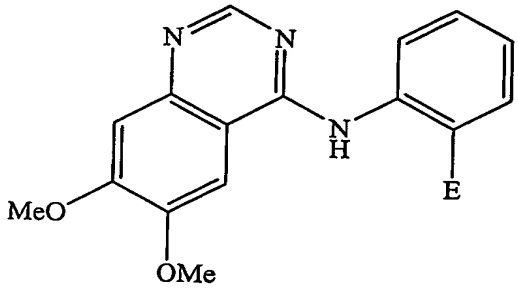
48. A method of inhibiting a protein kinase that has one or more cysteine residues within its ATP binding site, comprising contacting the kinase with an inhibitory-effective amount of a compound according to claim 2.

49. A method of inhibiting a protein kinase that has one or more cysteine residues within its ATP binding site, comprising contacting the kinase with an inhibitory-effective amount of a compound according to claim 3.

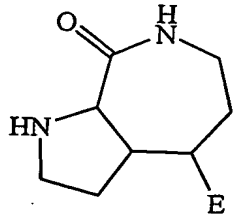
50. A method of inhibiting a protein kinase that has one or more cysteine residues within its ATP binding site, comprising contacting the kinase with an inhibitory-effective amount of a compound having the formula (II), (III), (IV) or (V):



(II)

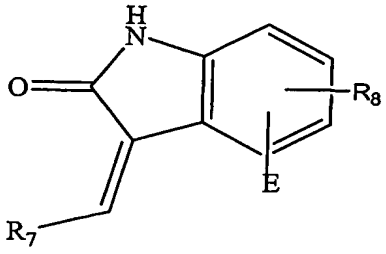


(III)



(IV)

or



(V)

in which R_6 is an optionally substituted aliphatic, aromatic or heterocyclic group; R_7 is a group having the formula $(CH_2)_bR^b$ wherein *b* is 0 or an integer from 1 to 3 and R^b is an optionally substituted aromatic, heterocyclic or cyclical aliphatic group;; R_8 is hydrogen or one or more substituents that do not affect the kinase-inhibiting properties of the said compounds, and E represents an electrophilic group that is capable of forming a covalent bond with a cysteine residue within the ATP binding site of a kinase.

51. A method of imparting to a protein kinase the capability of being inhibited by a compound having a heterocyclic core structure comprised of two or more fused rings containing at least one nitrogen ring atom, and an electrophilic substituent that is capable of reacting with a cysteine residue within the ATP binding site of a kinase, comprising replacing an amino acid residue other than a cysteine residue within the ATP binding site of the protein kinase with a cysteine residue.

52. A method of imparting to a protein kinase the capability of being inhibited by a compound having a heterocyclic core structure comprised of two or more fused rings containing at least one nitrogen ring atom, and an electrophilic substituent that is capable of forming a covalent bond with a cysteine residue within the ATP binding site of a kinase, comprising replacing a methionine, leucine, isoleucine, lysine, arginine, tryptophan, glutamine, asparagine, proline, tyrosine, histidine, glutamic acid, aspartic acid, valine, or phenylalanine residue in the gatekeeper position of the ATP binding site with a smaller residue.

53. A method for inhibiting the morphological transformation of a cell in which such a kinase is expressed comprising contacting the cell or the kinase with an inhibitory-effective amount of a compound having a heterocyclic core structure comprised of two or more fused rings containing at least one nitrogen ring atom, and an electrophilic substituent that is capable of forming a covalent bond with a cysteine residue within the ATP binding site of a kinase.

54. A method for inhibiting the proliferation of a tumor cell comprising contacting the cell with an inhibitory-effective amount of a compound having a heterocyclic core structure comprised of two or more fused rings containing at least one nitrogen ring atom, and an electrophilic substituent that is capable of forming a covalent bond with a cysteine residue within the ATP binding site of a kinase.

55. A method according to claim 54 in which the compound is a pyrrolopyrimidine.

56. A method according to claim 54 in which the compound is a compound according to claim 2.

57. A method according to claim 54 in which the compound is a compound according to claim 3.

58. A method according to claim 54 in which the compound is a compound according to any of claims 26-29.

59. A method according to claim 54 in which the cell is contacted with an inhibitory-effective amount of a plurality of such compounds.

60. An array for testing for inhibition of protein kinase activity comprising one or a plurality of compounds having a heterocyclic core structure comprised of two or more fused rings containing at least one nitrogen ring atom, and an electrophilic substituent that is capable of forming a covalent bond with a cysteine residue within the ATP binding site of a kinase.

61. A therapeutic composition comprising (a) a kinase inhibitory-effective amount of a composition according to any of claims 1- 46 and a pharmaceutically acceptable carrier.

62. A composition for inhibiting kinase activity comprising an effective inhibitory amount of a compound according to any of claims 1-46.

63. A composition according to claim 62 for inhibiting activity of a kinase selected from the group consisting of Rsk1,2,3,4, Msk1-2, Plk1-3, MEKK1, and Nek2.